MAP GQ-1653

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

GEOLOGIC MAP OF THE PELICAN BUTTE QUADRANGLE, KLAMATH COUNTY, OREGON

By James G. Smith

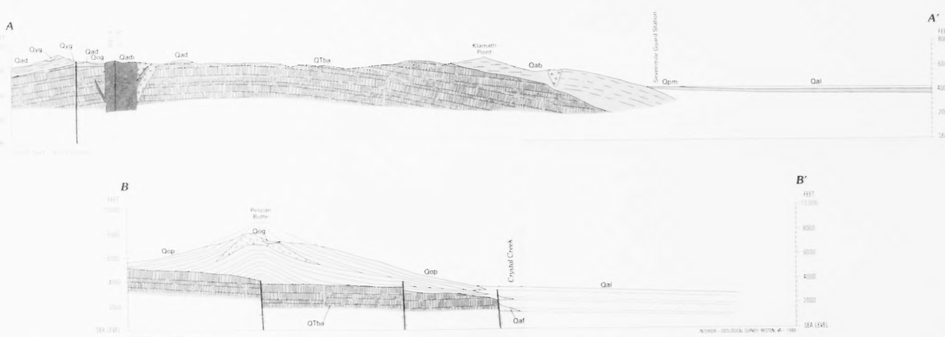
GEOLOGIC QUADRANGLE MAP
Published by the U.S. Geological Survey, 1988

NEW YORK
JUN 1 9 1989
STATE LIBRARY

SMITH—GEOLOGIC MAP, PELICAN BUTTE QUADRANGLE, OREGON 1:62,500 MAP GQ-1653

best copy available

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

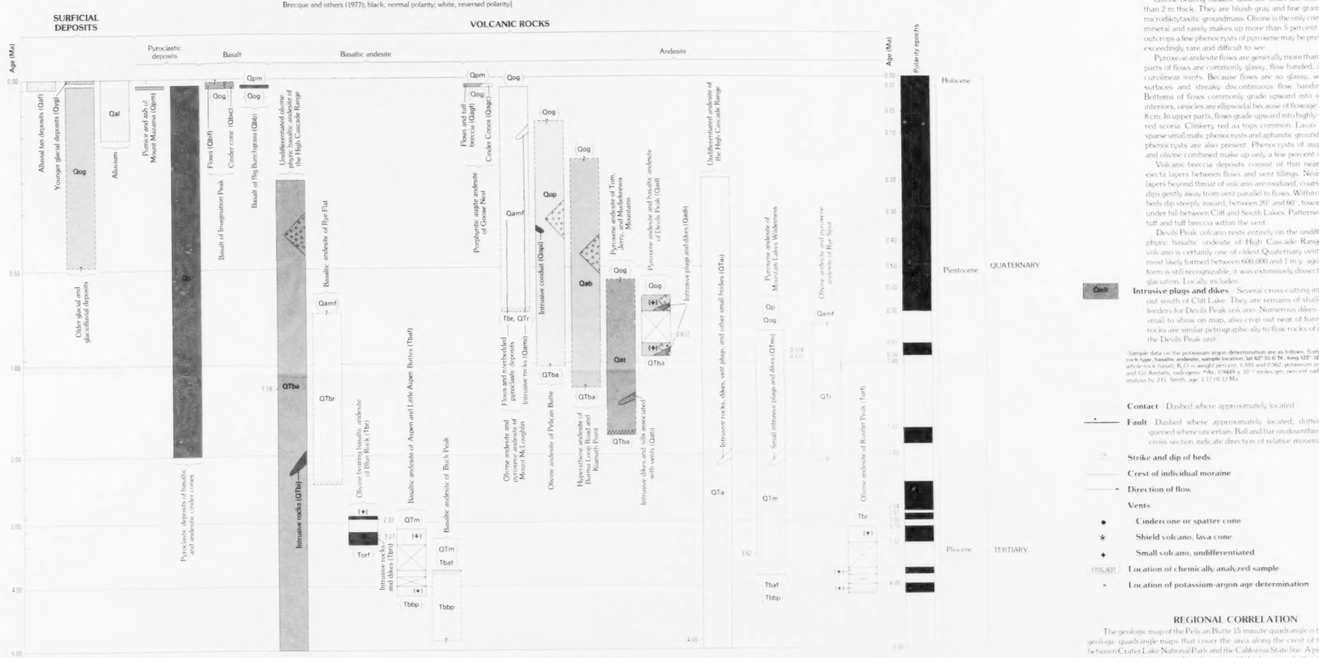


GEOLOGIC MAP OF THE PELICAN BUTTE QUADRANGLE, KLAMATH COUNTY, OREGON

By
James G. Smith
1988

CORRELATION OF MAP UNITS

[Colored units appear on map sheet; uncolored units do not appear on map but appear on other maps in the series and are used here for age correlations. See Smith (1983) for complete descriptions of units not appearing on this map. Polarity epochs from La Brecque and others (1977); black, normal polarity; white, reversed polarity]



EXPLANATION FOR CORRELATION OF MAP UNITS

Age constraints—Solid where relatively certain; dashed to show possible age range; queried where uncertain; diagonal where age precluded by magnetic polarity measurements; hachured where maximum age constrained by potassium-argon age determination, magnetic polarity measurement, or stratigraphy. Units in braces indicates stratigraphic constraints on basis of field relations

Measured polarity
- (+) **Normal**
- (–) **Reversed**

Potassium-argon age determination—In millions of years before present. See Fiebelkorn and others (1983) for analytical data and sample localities outside of quadrangle used for potassium-argon age determinations

DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Qaf **Alluvial fan deposits (Holocene)**—Unconsolidated, poorly sorted, crudely bedded, locally derived silt, sand, gravel, and boulders. Deposits typically form where streams flow into lakes and alluvial basins as along east edge of map.

Qyg **Younger glacial deposits (Holocene)**—Small areas of talus, rock glaciers, and neoglacial till mostly confined to cirques and headwalls of steep valleys along Cascade crest. Unit mapped only where prominently developed and where clearly distinguishable from the older glacial and glaciofluvial deposits (Qog). Unit overlies the pumice and ash of Mount Mazama (Qpm) (Carver, 1972) and is therefore younger than about 6,845±50 yr B.P. (Mehringer and others, 1977; Bacon, 1983a, b)

Qog **Older glacial and glaciofluvial deposits (Holocene and Pleistocene)**—Chiefly terminal and lateral moraines, drift, and glaciofluvial deposits; small areas underlain by the younger deposits (Qyg) are included. Glacial deposits are generally poorly exposed. All are unconsolidated. Oldest glacial deposits typically are deeply weathered with thick soils. Glacial deposits are commonly mantled by the pumice and ash of Mount Mazama (Qpm). Carver (1972) tentatively correlated glacial deposits within map area with better dated glacial successions in Sierra Nevada, Calif., and Cascade Range, Wash. His correlations suggested that most of the Cascade glacial deposits in southern Oregon, mapped here as the older glacial and glaciofluvial deposits, formed between 90,000 and 10,000 yr ago and that none are older than middle Pleistocene in age. Unit locally underlies the pumice and ash of Mount Mazama; therefore it is older than 6,845±50 yr (Mehringer and others, 1977; Bacon, 1983a, b)

Qal **Alluvium (Holocene and Pleistocene)**—Poorly to well-sorted, uncon-solidated, locally derived detritus, mainly silt, sand, gravel, and local layers or lenses of conglomerate. As mapped, unit includes the fine-grained silt and mud of pluvial Lake Modoc unit of Dicken (1980)

VOLCANIC ROCKS

Pyroclastic deposits

Qpm Pumice and ash of Mount Mazama (Holocene)—Unconsolidated, white, pink, buff, or gray dacitic and andesitic ash and pumice ejected from Mount Mazama during climactic eruption approximately 6,845±50 yr ago and, possibly, during earlier Holocene eruptions at Mount Mazama (Mehringer and others, 1977; Bacon, 1983a, b). Ash and pumice formed ash flow, ash cloud, and ash fall deposits. Most of the pumice and ash of Mount Mazama in quadrangle originated as ash-cloud deposits; they are shown on map only where their thickness (usually more than 2 m) obscures the identity of underlying bedrock. Ash-cloud deposits form where extremely fine, but still hot, ash settles from the convective cloud that accompanies an ash flow. Ash that settles on slopes commonly remobilizes and moves down even gentle grades as a fluidized flow, coming to rest in valley bottoms or other horizontal surfaces. Recent radiocarbon age determinations of organic materials associated with the climactic eruption of Mount Mazama date this event at about 6,845±50 yr B.P. (average of four determinations) (Bacon, 1983a) and 6,710±110 yr B.P. (average of two determinations) (Mehringer and others, 1977)

Qc **Pyroclastic deposits of basaltic and andesitic cinder cones (Holocene and Pleistocene)**—Mostly unconsolidated to poorly consolidated, well-stratified, red, brown, and black, fine- to coarse-grained, basaltic to andesitic ejecta of ash, cinders, scoria, agglutinate, and bombs. Unit, as mapped, includes minor lava flows and associated feeder dikes. Steep bedding and round or oval shape identify most of these deposits as cinder cones. Most are small, rarely more than 150 m high and 1.6 km across

Basalt

Basalt of Imagination Peak (Holocene)—Unit composed of a few short flows of vesicular pahoehoe and a cinder cone centered on Imagination Peak. Along Cold Spring trail, both ash from the cinder cone and flows cover the older glacial and glaciofluvial deposits (Qog). Thus, unit is younger than end of last glaciation, estimated by Carver (1972) at about 10,000 yr. Consists of:

Qbnf **Flows**—Fresh black vesicular basalt containing small olivine phenocrysts and prominent white plagioclase phenocrysts

Qbnc **Cinder cone**—Unconsolidated red and brown basaltic cinders, scoria, and ash. Same composition as associated flows

Qbb **Basalt of Big Bunchgrass (Holocene)**—Unit consists of a small shield volcano covering about 5 km² and composed of basalt flows 1 to 3 m thick. Flows issued from vent near Big Bunchgrass (hill 6631) on Cascade crest. Basalt is typically black or dark-gray porphyritic olivine basalt that may be scoriaceous or almost frothy, especially near tops of flows. Olivine forms euhedral to subhedral phenocrysts and glomerophenocrysts 0.5 to 1 mm in diameter; olivine content averages about 7 percent. Calcic labradorite forms euhedral phenocrysts and radiating incipient crystal clusters 0.5 to 2 mm long. Flows of this shield volcano overlie the older glacial and glaciofluvial deposits (Qog) on its northwest and southeast flanks. The pumice and ash of Mount Mazama (Qpm) extensively mantles northeast flank of volcano. These relations bracket age of unit between 10,000 (Carver, 1972) and 6,845±50 yr (Mehringer and others, 1977; Bacon, 1983a)

Basaltic andesite

QTba **Undifferentiated olivine phyric basaltic andesite of the High Cascade Range (Pleistocene and Pliocene)**—Thick to thin flows of blue-gray, massive olivine phyric basaltic andesite, volcanic breccia, dikes, vent plugs, and other small intrusive bodies. Unit consists of deeply eroded coalescing shield volcanoes. Lavas from different vents in unit are lithologically and texturally similar. Flows are generally fresh and mostly characterized by a distinct bluish-gray color. In most flows the only phenocryst is olivine, although in some flows a few plagioclase or pyroxene phenocrysts are present. Olivine phenocrysts are euhedral to subhedral, 2 to 4 mm in size, and constitute 3 to 7 percent. Most basaltic andesite samples have a distinctive groundmass that consists of a holocrystalline vesicular mesh of white plagioclase tablets 0.25 to 1 mm long. Spaces between plagioclase tablets are filled with anhedral pyroxene grains 0.1 to 0.7 mm in diameter, minor amounts of glass, which is always clear, and voids. In many samples, with abundant intergranular voids, the texture is microdiktytaxitic. Vent breccia and deeply eroded cinder cones shown by pattern. These deposits are composed of steeply dipping and poorly bedded layers of bombs, scoria blocks, cinders, ash, and locally, thin basaltic andesite flows. Thin feeder dikes cut deposits. Deposits are predominantly shades of red and commonly weather yellow. Deposits on east side of Maude Mountain are most likely from an eroded cinder cone and vent complex that erupted on west flank of a moderate sized basaltic andesite shield volcano, part of whose east flank is Bunker Hill. Locally includes:

QTbi **Intrusive rocks**—Dikes, vent plugs, and small intrusive bodies. Intrusive rocks generally similar to flow rocks of associated volcano, but have darker, more aphanitic groundmass than associated flow rocks

Olivine-bearing basaltic andesite of Blue Rock (Pliocene)—Typically light bluish-gray, fine-grained, microdiktytaxitic, olivine-bearing basaltic andesite similar to many flows of the undifferentiated olivine phyric basaltic andesite of the High Cascade Range (QTba). Only a very small part of unit crops out in Pelican Butte quadrangle. Outside quadrangle unit consists of extensive flows, volcanic breccia, and cogenetic near vent pyroclastic deposits. The sources of unit are two or three deeply glaciated shield volcanoes that lie about 3 km west of Pelican Butte quadrangle.

Duplicate splits of a sample from an extensive valley filling flow of this unit collected 12 km east in the Rustler Peak quadrangle (42°34'14" N., 122°23'45" W.) yielded potassium-argon ages of 3.27±0.17 and 2.92±0.11 Ma (Fiebelkorn and others, 1983)

Andesite

Porphyritic augite andesite of Goose Nest (Holocene)—Lava flows, pyroclastic(?) tuff breccia, mudflow tuff breccia, and to north of quadrangle a chain of cinder-cone deposits. Consists of:

Qaugf **Flows and tuff breccia**—Lava flows generally more than 2 m thick, dense at bottom, but increasingly vesicular toward top. Many flows follow channels and furrows cut into tuff breccia of this unit. Flows are characteristically fresh bluish gray—locally with purple tint—coarsely porphyritic, olivine bearing augite andesite. Phenocryst minerals are augite, olivine, and plagioclase. Augite forms deep green subhedral phenocrysts and glomerophenocrysts as large as 5 mm. Although they make up no more than 5 percent, these prominent crystals are the most distinctive feature of lavas. Green olivine forms phenocrysts 1 to 2.5 mm across; it constitutes 1 to 5 percent. Plagioclase (calcic labradorite) forms small euhedral tabular phenocrysts 0.5 to 1.5 mm long that are commonly strongly aligned parallel to flow direction; they make up 5 to 15 percent. Groundmass is fine grained and waxy looking in hand specimen.

Poorly exposed tuff breccia forms coarse, unstratified to poorly stratified, matrix-supported, unlithified deposits. Clasts are mineralogically and compositionally identical to flows, but the groundmass of clasts is finer grained. Clasts are generally nonvesicular and angular; maximum size is approximately 0.5 m across. In many places, surfaces of tuff breccia deposits have ridges and furrows approximately radially aligned to vents. Relief between ridges and furrows is several meters. Initial dips of 5° to 15° were observed in roadcuts of tuff breccia. These features suggest that some of these deposits are pyroclastic flow deposits (Miller, 1978). Others are mudflows or air-fall deposits.

The porphyritic augite andesite of Goose Nest is young. Cinder cones north of Pelican Butte quadrangle still have central pits and are largely unmodified by erosion and lack thick soils; flows and volcaniclastic parts of unit also display most of their original morphology. Mudflows bank against, and partly cover, glacial moraine and till on Wildcat Creek 5 km north of quadrangle and in unnamed drainages along south margin of unit. Glacial deposits are considered to be no younger than 10,000 yr (Carver, 1972). The pumice and ash of Mount Mazama (Qpm), deposited about 6,845±50 yr ago (Mehringer and others, 1977; Bacon, 1983a), partly covers distal lobes of lava and mudflows just north of the quadrangle between Annie Creek and Dry Creek. Pumice lumps ejected from Mount Mazama during its climactic eruption are common in soils on this unit and loose pumice lapilli and ash of Mt. Mazama are present in central pits of cinder cones. These relations indicate that the porphyritic augite andesite of Goose Nest formed between approximately 10,000 and 6,845 yr ago

Qop **Olivine andesite of Pelican Butte (Pleistocene)**—Porphyroaphanitic, black and dark bluish gray, generally finely vesicular, mostly glassy, phenocryst poor andesite flows, interbedded volcanic breccia, vent breccia, and a small intrusive conduit plugged by lava. Unit forms beautifully symmetrical, 2,450-m-high, steep-sided Pelican Butte shield volcano.

Two main types of andesite characterize the flows. One type is a fine-grained vesicular andesite that forms thin flows that have scoriaceous and blocky tops. Lavas of this type are common near summit of Pelican Butte. They are characterized in hand specimen by small snow-white plagioclase phenocrysts of sodic labradorite. Phenocrysts of mafic minerals are not easily seen in hand specimen and are difficult to identify in hand specimen. Phenocrysts of olivine, augite, and hypersthene together make up as much as 15 percent; they average between 5 and 10 percent. Maximum length is 1.6 mm and their average size is about 0.5 mm. Relative proportions vary, although hypersthene is commonly more abundant than augite; both pyroxenes are more abundant than olivine, and olivine is absent in some samples. Both pyroxenes are always fresh, but olivine is commonly corroded with rims of iddingsite.

The other type of lava is a mostly nonvesicular andesite that forms thick platy flows. These generally traveled far down flanks of volcano following preexisting channels. Flows are typically aphyric or nearly aphyric glassy andesite. They are blue gray with distinctive thin white lensoid streaks subparallel to flow directions. Phenocryst minerals are plagioclase, augite, hypersthene, and, in some samples, olivine; all are inconspicuous and present in different proportions in different samples. Collectively they make up no more than a few percent of the lava.

Volcanic breccia is poorly exposed. Available exposures suggest that a significant, but unknown, part of the volcano consists of volcanic breccia layers sandwiched between lava flows. Different types of volcanic breccia include pyroclastic flows, mudflows, breccia levees along margins of lava flows, and flow breccia. Pattern on map represents tuff breccia and lapilli tuff near summit of Pelican Butte formed during a late pyroclastic phase. Thin andesite flows partly cover breccia and tuff and formerly covered even more pyroclastic deposits, but erosion has removed much of covering flows and underlying pyroclastic deposits.

The age of the olivine andesite of Pelican Butte is constrained by stratigraphic relations, a potassium-argon determination, magnetic data, and geomorphic development. The undifferentiated olivine phyric basaltic andesite of the High Cascade Range (QTba) everywhere underlies the Pelican Butte unit. Approximately 1 km west of Big Meadow, the undifferentiated olivine phyric basaltic andesite of the High Cascade Range is cut by a fault. A flow of the undifferentiated olivine phyric basaltic andesite of the High Cascade Range just west of the fault was dated at 1.17±0.12 Ma. A few flows of the Pelican Butte unit butt up against the fault scarp but are not offset by the fault. Therefore, the maximum age of fault movement and the olivine andesite of Pelican Butte is approximately 1.2 Ma.

An aeromagnetic survey shows a 200-milligal high over Pelican Butte, indicating that a majority of rocks of the Pelican Butte unit are normally polarized (Blakely, 1986). Pelican Butte is not extensively glaciated, although a 120-m-deep glacial canyon was carved into the northeast side. Erosion has lowered the summit perhaps as much as 90 m, but symmetry of original shield volcano is preserved over a surface greater than 270°. Isotopic, erosional, and paleomagnetic evidence indicates that Pelican Butte is no older than 1 Ma and that most of the volcano probably formed within a relatively short time interval between 700,000 and 200,000 yr ago. Locally includes:

Qadc **Intrusive conduit**—Conduit plugged by lava associated with central vent. Rocks from conduit are lithologically identical to flow rocks of major part of the Pelican Butte unit

Qab **Hypersthene andesite of Burma Loop Road and Klamath Point (Pleistocene)**—Dominantly blocky weathering, porphyroaphanitic, commonly sparsely porphyritic, blue-gray, hypersthene andesite flows, poorly exposed interbedded volcanic flow breccia, and vent breccia. Platy, inconspicuously porphyritic olivine bearing pilotaxitic andesite makes up a subordinate amount of unit. Rocks of unit comprise two volcanic features: (1) a relatively older and largely eroded volcanic represented by Klamath Point and surrounding slopes, and (2) a younger, more intact volcano of Burma Loop Road, whose vent area, however, is still identifiable.

Flows of both volcanoes are dominantly hypersthene andesite with or without augite or olivine. Individual flows are generally thicker than 1 m. They are commonly platy parts clearly near their bases and are commonly vesicular to rubbly near their tops; they are porphyroaphanitic with conspicuous white plagioclase phenocrysts through out. Phenocrysts make up 15 to 25 percent of rock. Euhedral labradorite 1 to 2 mm in size is the most abundant phenocryst mineral, ranging from 10 to 20 percent. Euhedral to subhedral, prismatic hypersthene makes up 5 to 15 percent; crystals are either deep green to nearly black or dark brown. Augite is present in only a few flows; it forms subhedral to subhedral emerald green phenocrysts and glomerophenocrysts. Most augite phenocrysts are between 1 and 1.5 mm but a few are as large as 4 mm. Subhedral olivine phenocrysts 0.5 to 1 mm in size are present, but rarely make up more than 1 to 2 percent of any flow. Olivine andesite flows are generally thin and platy, throughout; phenocrysts of olivine and a few plagioclase crystals are small and inconspicuous.

Volcanic breccia is probably an important component of this unit but is so poorly exposed that it is difficult to determine. Volcanic breccia layers interbedded with flows are exposed in only a few roadcuts. Patterned area 1.8 km northeast of Klamath Point is interpreted as a scoria and breccia filled vent on the basis of cobbles and boulders of vesicular pyroxene andesite and scalty soil.

Age of volcanoes is poorly constrained but best estimate is that they were active sometime between a few hundred thousand to a little more than 1 m.y. ago. Both volcanoes lap onto older, more eroded flows assigned to the undifferentiated olivine phyric basaltic andesite of the High Cascade Range (QTba). Pleistocene glaciers carved deeply into north sides of both Klamath Point and Burma Loop volcanoes. The Klamath Point volcano is much more deeply eroded than the Burma Loop volcano and was probably partly older.

Qam **Pyroxene andesite of Tom, Jerry, and Mudhenhawk Mountains (Pleistocene)**—Olivine-bearing basaltic andesite and generally dark porphyroaphanitic pyroxene andesite flows, interbedded volcanic breccia, vent breccia, and dikes. The volcanic products built several coalescing, deeply dissected, composite shield volcanoes. Most of unit, including vent areas, lies north and west of quadrangle.

Lavas of Tom, Jerry, and Mudhenhawk Mountains are composed of about equal amounts of olivine-bearing basaltic andesite and pyroxene andesite. Flows of these two rock types are interlayered, suggesting that flows of different composition were erupted alternately from the same vent.

Basaltic andesite flows are generally 1 to 3 m thick and vesicular, especially near their tops. Most rocks are porphyroaphanitic. Phenocrysts make up from a trace to 15 percent. Olivine and plagioclase are most abundant phenocrysts, in many rocks they are the only phenocrysts. Small inconspicuous, euhedral phenocrysts of clinopyroxene or orthopyroxene are present in some samples. They form as much as 1 percent of rock, and they are not found together in any one flow.

Pyroxene andesite flows are commonly 2 to 10 m thick, with glassy, platy, dense lower parts, dense, nonvesicular fine-grained interiors, and blocky or scoriaceous tops. Phenocrysts are more conspicuous than in olivine-bearing basaltic andesite flows of this unit. Pyroxene andesite is generally porphyroaphanitic, more distinctly so than the basalt andesite. Phenocrysts make up 5 to 30 percent. Plagioclase is most phenocryst mineral and is always accompanied by at least one pyroxene. Overall, clinopyroxene is more common than orthopyroxene. Some flows contain augite phenocrysts and clumps of phenocrysts as large as 7 mm. Olivine is rare and inconspicuous. It is most commonly found in flows that also contain both augite and hypersthene phenocrysts, but whose total phenocryst content is less than 2 percent.

Volcanic breccia interbedded with flows is poorly exposed. Where exposed, it consists of poorly bedded and unsorted or poorly sorted tuff breccia and lapilli tuff. Extensions of larger clasts and ashy matrices between clasts are commonly shades of red because of oxidation. Clasts are the same composition as enclosing flows and are believed to represent explosive phases of volcanism.

The volcanic edifices of this unit were built on flows of the undifferentiated olivine phyric basaltic andesite of the High Cascade Range (QTba). A sample of underlying olivine phyric basaltic andesite collected 4.5 km west of quadrangle from north wall of canyon of the Middle Fork of the Rogue River (42°43'46" N., 122°18.33' W.) 125 m below the contact of the two units yielded a potassium-argon age of 2.69±0.08 Ma (Fiebelkorn and others, 1983). Many canyons and cirques are carved into shield volcanoes, and they are partly filled by the older glacial and glaciofluvial deposits (Qog), which indicates that volcanoes are older than last major glacial advance. Locally includes:

Qadc **Intrusive dikes and sills associated with vents**—Most intrusive bodies are too small, discontinuous, or poorly exposed to show on map. Dikes and sills are dense black to dark gray, fine grained to aphanitic, and less porphyritic than flow rocks of major part of the Tom, Jerry, and Mudhenhawk Mountains unit

Qad **Pyroxene andesite and basaltic andesite of Devils Peak (Pleistocene)**—Alternating flows of platy, sparsely porphyritic pyroxene andesite and thin flows of olivine bearing basaltic andesite, apparently erupted from same vents; layers of pyroclastic breccia, found mostly near vents; vent breccia; and an intrusive plug. Unit consists of a deeply eroded, steep-sided shield volcano with extensive flows extending east and west across Cascade crest for about 10 km. Devils Peak and peaks near crest of Cascades mark remains of former summit area.

Olivine-bearing basaltic andesite flows are thin and rarely more than 2 m thick. They are bluish gray and fine grained; many have a microdiktytaxitic groundmass. Olivine is the only common phenocryst mineral and rarely makes up more than 5 percent of rock. In some outcrops a few phenocrysts of pyroxene may be present, but they are exceedingly rare and difficult to see.

Pyroxene andesite flows are generally more than 3 m thick. Lower parts of flows are commonly glassy, flow banded, and exhibit platy, curvilinear joints. Because flows are so glassy, waxy looking joint surfaces and streaky, discontinuous flow banding are common. Bottoms of flows commonly grade upward into strongly vesicular interiors; vesicles are ellipsoidal because of flowage and are as long as 8 cm. In upper parts, flows grade upward into highly vesicular lava and red scoria. Clinkery, red aa tops common. Lavas characterized by sparse small mafic phenocrysts and aphanitic groundmass. Plagioclase phenocrysts are also present. Phenocrysts of augite, hypersthene, and olivine combined make up only a few percent of any sample.

Volcanic breccia deposits consist of thin near vent pyroclastic-ejecta layers between flows and vent fillings. Near vent pyroclastic layers beyond throat of volcano are oxidized, coarse tuff breccia that dips gently away from vent parallel to flows. Within throat of volcano, beds dip steeply inward, between 20° and 60°, toward presumed vent under hill between Cliff and South Lakes. Patterned area represents tuff and tuff breccia within the vent.

Devils Peak volcano rests entirely on the undifferentiated olivine phyric basaltic andesite of High Cascade Range (QTba). Shield volcano is certainly one of oldest Quaternary vents in study area. It most likely formed between 600,000 and 1 m.y. ago. Although overall form is still recognizable, it was extensively dissected by Pleistocene glaciation. Locally includes:

Qadc **Intrusive plugs and dikes**—Several cross-cutting intrusive plugs crop out south of Cliff Lake. They are remains of shallow intrusions and feeders for Devils Peak volcano. Numerous dikes and sills, most too small to show on map, also crop out near of former vent. Intrusive rocks are similar petrographic ally to flow rocks of main part (Qad) of the Devils Peak unit

Sample data on the potassium-argon determination are as follows: Sample number, 7505A082; rock type, basaltic andesite; sample location, lat 42°33.6' N., long 122° 12.0' W.; material dated, whole rock basalt; K_2O in weight percent, 0.555 and 0.562; potassium analysis by J.H. Christie and G.J. Aerlants; radiogenic ^{40}Ar, 0.9689 x 10^{-5} moles/gm; percent radiogenic ^{40}Ar, 12; argon analysis by J.G. Smith; age, 1.17±0.12 Ma.

Contact—Dashed where approximately located

Fault—Dashed where approximately located, dotted where inferred; queried where uncertain. Bar and bar on downthrown side. Arrows in cross section indicate direction of relative movement

Strike and dip of beds

Crest of individual moraine

Direction of flow

Vents
- **Cinder cone or spatter cone**
- **Shield volcano, lava cone**
- **Small volcano, undifferentiated**

7705.831 **Location of chemically analyzed sample**

× **Location of potassium-argon age determination**

REGIONAL CORRELATION

The geologic map of the Pelican Butte 15-minute quadrangle is the first of a series of geologic quadrangle maps that cover the area along the crest of the Cascade Range between Crater Lake National Park and the California State line. A preliminary version of parts of some of these quadrangles was published previously (Smith, 1986). The same format, units, unit symbols, and colors will be used throughout the series in order to assist the user of these maps in understanding and understanding the geology. In all, there will be more than 50 rock units. Few units cover more than several square kilometers and none are regionally extensive enough to be used as stratigraphic markers in the usual sense. The age of each unit was determined by a combination of geologic mapping, potassium-argon dating, and measurement of the magnetic polarity of selected units.

Stratigraphic relations, rock types, and age assignment and certainty are shown in the Correlation of Map Units for units both within and surrounding the Pelican Butte quadrangle. Unit symbols that are placed in braces over and under boxes in the correlation indicate stratigraphic and stratigraphic relations. For example, the older glacial and glaciofluvial deposits (Qog) locally underlies the porphyritic augite andesite of Goose Nest; therefore, the porphyritic augite andesite of Goose Nest can be inferred that the older glacial and glaciofluvial deposits and. Further detailed mapping or radiometric determinations would refine the time of formation for many units.

Magnetic polarity was measured on samples collected in the field or, for a few distant localities, interpreted from an aeromagnetic map of the area (Blakely, 1986). As set at 1 in used in the Correlation of Map Units to indicate normal or reversed polarity. Dots in boxes through part of unit indicate areas of paleomagnetic measurements. For example, field mapping and a paleomagnetic age determination indicate that the pyroxene andesite of Devils Peak formed between 0.90 and 0.60 m.y. ago. This period of time includes parts of the Brunhes Normal and Matuyama Reversed Polarity Chrons, including the Jaramillo Normal Polarity Subchron of the Matuyama. However, all the rocks measured have a normal magnetic polarity and thus the unit could not have formed during the reversed part of the Matuyama (between 0.70 and 0.90 m.y. ago). Accordingly, this part of the unit box is shown with diagonal lines.

Many map units in the region are dated by potassium-argon methods, but only one sample site is within the Pelican Butte quadrangle. Determinations on samples from all the others are shown on the Correlation of Map Units. Complete sample locations, analytical data for dated samples are given in Fiebelkorn and others (1983).

REFERENCES

Bacon, C.R., 1983a, Eruptive history of Mount Mazama, Cascade Range, U.S.A.: Journal of Volcanology and Geothermal Research, v. 18, p. 57–115.

———1983b, The pre-climactic and climactic eruptions of Mount Mazama and collapse of Crater Lake caldera, Oregon [abs.]: Geological Society of America Abstracts with Programs, v. 15, no. 5, p. 330.

Blakely, R.J., 1986, Magnetic shading, aeromagnetic data and interpretation of the Medford 1°x2° quadrangle, Oregon and California: U.S. Geological Survey, Miscellaneous Field Studies Map MF-1903-B, scale 1:250,000, 2 sheets.

Carver, G.A., 1972, Glacial geology of the Mountain Lakes Wilderness and other parts of the Cascade Range, Oregon: Seattle, Wash., University of Washington, Ph.D. dissertation, 76 p.

Dicken, S.N., 1980, Pluvial Lake Modoc, Klamath County, Oregon, and Modoc and Siskiyou Counties, California: Oregon Geology, v. 42, no. 11, p. 163–168.

Fiebelkorn, R.B., Walker, G.W., MacLeod, N.S., McKee, E.H., and Smith, J.G., 1983, Index to K-Ar age determinations for the Stanley Mountain quadrangle, Oregon: U.S. Geological Survey Open-File Report 83-0382, 18 p.

La Brecque, J.L., Kent, D.V., and Cande, S.C., 1977, Revised magnetic polarity time scale for late Cretaceous and Cenozoic time: Geology, v. 5, no. 6, p. 330–335.

Mehringer, P.J., Jr., Blinman, Eric, and Petersen, K.L., 1977, Pollen influx and volcanic ash: Science, v. 198, no. 4314, p. 257–261.

Miller, C.D., 1978, Holocene pyroclastic flow deposits from Shastina and Black Butte, west of Mount Shasta, California: U.S. Geological Survey Journal of Research, v. 6, no. 5, p. 611–624.

Shapiro, Leonard, and Brannock, W.W., 1962, Rapid analysis of silicate, carbonate, and phosphate rocks: U.S. Geological Survey Bulletin 1144-A, 56 p.

Smith, J.G., 1983, Geologic map of the Sky Lakes Roadless Area and Mountain Lake Wilderness, Jackson and Klamath Counties, Oregon: U.S. Geological Survey Miscellaneous Field Studies Map MF-1569-A

TABLE 1. *Chemical analyses of hypersthene andesite and olivine andesite*

[Major oxide analyses (in weight percent) by N. Skinner using rapid rock methods described by Shapiro and Brannock (1962). Trace element analyses for parts per million by J. Schwartz using instrumental neutron activation techniques. Zr and Y analyses (in parts per million) by N. Rait using emission spectrographic]

Constituent	7705.831 (USGS No. W-0706)	7505.084 (USGS No. W-0710)
Major oxides (in weight percent)		
SiO_2	60.3	58.1
Al_2O_3	17.9	17.6
Fe_2O_3	3.0	2.4
FeO	2.7	4.1
MgO	3.4	3.9
CaO	6.7	7.1
Na_2O	3.1	3.9
K_2O	1.2	0.84
H_2O^+	0.23	0.76
H_2O^-	0.14	0.21
TiO_2	0.76	0.75
P_2O_5	0.17	0.19
MnO	0.11	0.12
CO_2	0.01	0.01
Total	100.74	100.74
Trace elements (in parts per million)		
Ba	530	439
Co	19.4	20.6
Cr	41.4	44.1
Ce	28.0	29.6
Hf	2.7	2.5
Rb	40	34
Sc	20	21.6
Ta	0.32	0.33
Th	1.7	1.6
U	0.7	0.8
Y	20	20
Zn	63	66
Zr	102	122
Sr	343	329
La	15	18
Ce	27	35
Nd	17	19
Sm	3.2	3.9
Eu	1.0	1.06
Gd	3.4	3.6
Tb	0.59	0.6
Ho	0.6	0.5
Tm	0.27	0.26
Yb	1.8	1.4
Lu	0.23	0.20

best copy available

GEOLOGIC MAP SYMBOLS

COMMONLY USED ON MAPS OF THE UNITED STATES GEOLOGICAL SURVEY

(Special symbols are shown in explanation)

Contact – Dashed where approximately located; short dashed where inferred; dotted where concealed

Contact – Showing dip; well exposed at triangle

Fault – Dashed where approximately located; short dashed where inferred; dotted where concealed

Fault, showing dip – Ball and bar on downthrown side

Normal fault – Hachured on downthrown side

Fault – Showing relative horizontal movement

Thrust fault – Sawteeth on upper plate

Anticline – Showing direction of plunge; dashed where approximately located; dotted where concealed

Asymmetric anticline – Short arrow indicates steeper limb

Overturned anticline – Showing direction of dip of limbs

Syncline – Showing direction of plunge; dashed where approximately located; dotted where concealed

Asymmetric syncline – Short arrow indicates steeper limb

Overturned syncline – Showing direction of dip of limbs

Monocline – Showing direction of plunge of axis

Minor anticline – Showing plunge of axis

Minor syncline – Showing plunge of axis

Strike and dip of beds – Ball indicates top of beds known from sedimentary structures

Inclined ⊕ Horizontal

Vertical Overturned

Strike and dip of foliation

Inclined Vertical Horizontal

Strike and dip of cleavage

Inclined Vertical Horizontal

Bearing and plunge of lineation

Inclined Vertical Horizontal

Strike and dip of joints

Inclined Vertical Horizontal

Note: planar symbols (strike and dip of beds, foliation or schistosity, and cleavage) may be combined with linear symbols to record data observed at same locality by superimposed symbols at point of observation. Coexisting planar symbols are shown intersecting at point of observation.

Shafts

Vertical Inclined

Adit, tunnel, or slope

Accessible Inaccessible

Prospect

Quarry

Active Abandoned

Gravel pit

Active Abandoned

Oil well

Drilling Shut-in Dry hole abandoned

Gas Show of gas

Oil Show of oil

best copy available